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Search	Protein	<input type="checkbox"/> for nm23 or nm23H1 or nm23H2						Go	Clear
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☐ **1: Q9Y5B8** [BLink](#), [Domains](#), [Links](#)
Nucleoside diphosphate kinase 7 (NDK 7) (NDP kinase 7) (nm23-H7)
gi|12230353|sp|Q9Y5B8|NDK7_HUMAN[12230353]

Related resources

☐ **2: Q9QXL8** [BLink](#), [Domains](#), [Links](#)
Nucleoside diphosphate kinase 7 (NDK 7) (NDP kinase 7) (nm23-M7)
gi|12230347|sp|Q9QXL8|NDK7_MOUSE[12230347]

☐ **3: Q9QXL7** [BLink](#), [Domains](#), [Links](#)
Nucleoside diphosphate kinase 7 (NDK 7) (NDP kinase 7) (nm23-R7)
gi|12230331|sp|Q9QXL7|NDK7_RAT[12230331]

☐ **4: P15531** [BLink](#), [Domains](#), [Links](#)
Nucleoside diphosphate kinase A (NDK A) (NDP kinase A) (Tumor metastatic process-associated protein) (Metastasis inhibition factor nm23) (nm23-H1) (Granzyme A-activated DNase) (GAAD)
gi|127981|sp|P15531|NDKA_HUMAN[127981]

☐ **5: NP_116262** [BLink](#), [Domains](#), [Links](#)
Cbl-interacting protein Sts-1; SH3 domain-containing 70 kDa protein; nm23-phosphorylated unknown substrate [Homo sapiens]
gi|24497612|ref|NP_116262.2|[24497612]

☐ **6: NP_571001** [BLink](#), [Domains](#), [Links](#)
non-metastatic cells 2, protein (NM23B) expressed in; nucleoside diphosphate kinase-Z1 [Danio rerio]
gi|18859107|ref|NP_571001.1|[18859107]

☐ **7: O00746** [BLink](#), [Domains](#), [Links](#)
Nucleoside diphosphate kinase, mitochondrial precursor (NDP kinase, mitochondrial) (NDK) (nm23-H4) (Nucleoside diphosphate kinase D) (NDPKD)
gi|2498075|sp|O00746|NDKM_HUMAN[2498075]

- ☐ **8: P22392** BLink, Domains, Links
Nucleoside diphosphate kinase B (NDK B) (NDP kinase B) (nm23-H2)
(C-myc purine-binding transcription factor PUF)
gi|127983|sp|P22392|NDKB_HUMAN[127983]
- ☐ **9: CAA53270** BLink, Domains, Links
nm23H1g [Homo sapiens]
gi|468542|emb|CAA53270.1|[468542]
- ☐ **10: CAA35621** BLink, Domains, Links
Nm23 protein [Homo sapiens]
gi|35068|emb|CAA35621.1|[35068]
- ☐ **11: NP_056542** BLink, Domains, Links
tachykinin receptor 1 isoform short; neurokinin 1 receptor; Tachykinin
receptor 1 (substance P receptor; neurokinin-1 receptor); NK-1 receptor;
tachykinin 1 receptor (substance P receptor, neurokinin 1 receptor) [Homo
sapiens]
gi|7669546|ref|NP_056542.1|[7669546]
- ☐ **12: NP_001049** BLink, Domains, Links
tachykinin receptor 1 isoform long; neurokinin 1 receptor; Tachykinin
receptor 1 (substance P receptor; neurokinin-1 receptor); NK-1 receptor;
tachykinin 1 receptor (substance P receptor, neurokinin 1 receptor) [Homo
sapiens]
gi|4507343|ref|NP_001049.1|[4507343]
- ☐ **13: XP_488385** BLink, Links
similar to Regulator of G-protein signaling 3 (RGS3) [Mus musculus]
gi|51772517|ref|XP_488385.1|[51772517]
- ☐ **14: XP_380045** BLink, Links
PREDICTED: similar to Nucleoside diphosphate kinase, mitochondrial
precursor (NDP kinase, mitochondrial) (NDK) (nm23-H4) (Nucleoside
diphosphate kinase D) (NDPKD) [Homo sapiens]
gi|51492856|ref|XP_380045.2|[51492856]
- ☐ **15: XP_380047** BLink, Links
PREDICTED: similar to Nucleoside diphosphate kinase, mitochondrial
precursor (NDP kinase, mitochondrial) (NDK) (nm23-H4) (Nucleoside
diphosphate kinase D) (NDPKD) [Homo sapiens]
gi|51492854|ref|XP_380047.2|[51492854]
- ☐ **16: NP_001001392** BLink, Domains, Links
CD44 antigen isoform 5 precursor; cell surface glycoprotein CD44; Lutheran
inhibitor, dominant; homing function and Indian blood group system;
monoclonal antibody A3D8; antigen gp90 homing receptor; CDW44 antigen;

phagocytic glycoprotein I; extracellular matrix receptor-III; GP90
lymphocyte homing/adhesion receptor; heparan sulfate proteoglycan; cell
adhesion molecule (CD44); hyaluronate receptor; Hermes antigen [Homo
sapiens]
gi|48255943|ref|NP_001001392.1|[48255943]

☐ **17:** [NP_001001391](#)

[BLink](#), [Domains](#), [Links](#)

CD44 antigen isoform 4 precursor; cell surface glycoprotein CD44; Lutheran
inhibitor, dominant; homing function and Indian blood group system;
monoclonal antibody A3D8; antigen gp90 homing receptor; CDW44 antigen;
phagocytic glycoprotein I; extracellular matrix receptor-III; GP90
lymphocyte homing/adhesion receptor; heparan sulfate proteoglycan; cell
adhesion molecule (CD44); hyaluronate receptor; Hermes antigen [Homo
sapiens]
gi|48255941|ref|NP_001001391.1|[48255941]

☐ **18:** [NP_001001390](#)

[BLink](#), [Domains](#), [Links](#)

CD44 antigen isoform 3 precursor; cell surface glycoprotein CD44; Lutheran
inhibitor, dominant; homing function and Indian blood group system;
monoclonal antibody A3D8; antigen gp90 homing receptor; CDW44 antigen;
phagocytic glycoprotein I; extracellular matrix receptor-III; GP90
lymphocyte homing/adhesion receptor; heparan sulfate proteoglycan; cell
adhesion molecule (CD44); hyaluronate receptor; Hermes antigen [Homo
sapiens]
gi|48255939|ref|NP_001001390.1|[48255939]

☐ **19:** [NP_001001389](#)

[BLink](#), [Domains](#), [Links](#)

CD44 antigen isoform 2 precursor; cell surface glycoprotein CD44; Lutheran
inhibitor, dominant; homing function and Indian blood group system;
monoclonal antibody A3D8; antigen gp90 homing receptor; CDW44 antigen;
phagocytic glycoprotein I; extracellular matrix receptor-III; GP90
lymphocyte homing/adhesion receptor; heparan sulfate proteoglycan; cell
adhesion molecule (CD44); hyaluronate receptor; Hermes antigen [Homo
sapiens]
gi|48255937|ref|NP_001001389.1|[48255937]

☐ **20:** [NP_000601](#)

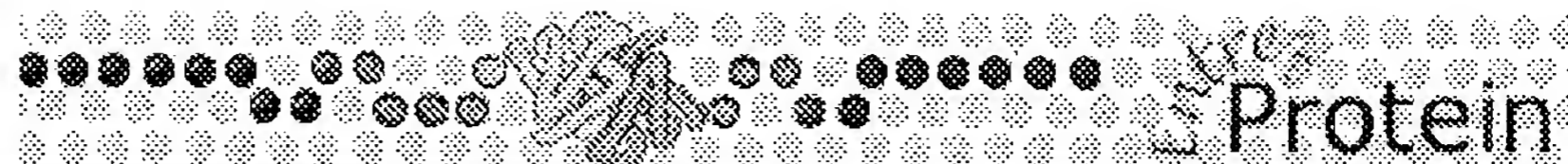
[BLink](#), [Domains](#), [Links](#)

CD44 antigen isoform 1 precursor; cell surface glycoprotein CD44; Lutheran
inhibitor, dominant; homing function and Indian blood group system;
monoclonal antibody A3D8; antigen gp90 homing receptor; CDW44 antigen;
phagocytic glycoprotein I; extracellular matrix receptor-III; GP90
lymphocyte homing/adhesion receptor; heparan sulfate proteoglycan; cell
adhesion molecule (CD44); hyaluronate receptor; Hermes antigen [Homo
sapiens]
gi|48255935|ref|NP_000601.3|[48255935]

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ATP-binding cassette sub-family B member 1; multidrug resistance 1; P
glycoprotein 1; doxorubicin resistance; colchicin sensitivity [Homo sapiens]
[gi|42741659|ref|NP_000918.2|](#)[\[42741659\]](#)

Related resources

☐ **22: [NP_963998](#)**[BLink](#), [Domains](#), [Links](#)

thromboxane A2 receptor isoform 2 [Homo sapiens]
[gi|42518082|ref|NP_963998.1|](#)[\[42518082\]](#)

☐ **23: [NP_000305](#)**[BLink](#), [Domains](#), [Links](#)

phosphatase and tensin homolog; tensin homolog; MMAC1 phosphatase and
tension homolog deleted on chromosome 10; mutated in multiple advanced
cancers 1 [Homo sapiens]
[gi|38505205|ref|NP_000305.2|](#)[\[38505205\]](#)

☐ **24: [NP_942126](#)**[BLink](#), [Domains](#), [Links](#)

ras-related C3 botulinum toxin substrate 1 isoform Rac1c; rho family, small
GTP binding protein Rac1 [Homo sapiens]
[gi|38505165|ref|NP_942126.1|](#)[\[38505165\]](#)

☐ **25: [NP_937818](#)**[BLink](#), [Domains](#), [Links](#)

nucleoside-diphosphate kinase 1 isoform a [Homo sapiens]
[gi|38045913|ref|NP_937818.1|](#)[\[38045913\]](#)

☐ **26: [NP_032730](#)**[BLink](#), [Domains](#), [Links](#)

nucleoside-diphosphate kinase 1; nucleotide diphosphate kinase [Mus
musculus]
[gi|37700232|ref|NP_032730.1|](#)[\[37700232\]](#)

☐ **27: [NP_002504](#)**[BLink](#), [Domains](#), [Links](#)

nucleoside-diphosphate kinase 3; NM23-H3 [Homo sapiens]
[gi|37693993|ref|NP_002504.2|](#)[\[37693993\]](#)

- ☐ **28:** [NP_872590](#) BLink, Domains, Links
proliferating cell nuclear antigen; cyclin; DNA polymerase delta auxiliary protein [Homo sapiens]
[gi|33239451|ref|NP_872590.1|](#)[\[33239451\]](#)
- ☐ **29:** [NP_057700](#) BLink, Domains, Links
NM23-H8; sperm-specific thioredoxin 2; thioredoxin domain-containing 3 (spermatozoa) [Homo sapiens]
[gi|31543836|ref|NP_057700.2|](#)[\[31543836\]](#)
- ☐ **30:** [NP_113751](#) BLink, Domains, Links
nuclease sensitive element binding protein 1; Y box protein 1 [Rattus norvegicus]
[gi|31543347|ref|NP_113751.2|](#)[\[31543347\]](#)
- ☐ **31:** [NP_775482](#) BLink, Domains, Links
PRUNEM1 [Mus musculus]
[gi|27597069|ref|NP_775482.1|](#)[\[27597069\]](#)
- ☐ **32:** [NP_008845](#) BLink, Domains, Links
RAR-related orphan receptor B; retinoic acid-binding receptor beta; nuclear receptor RZR-beta; RAR-related orphan receptor beta [Homo sapiens]
[gi|19743907|ref|NP_008845.2|](#)[\[19743907\]](#)
- ☐ **33:** [NP_599024](#) BLink, Domains, Links
RAR-related orphan receptor A isoform d; retinoic acid receptor-related orphan receptor alpha; transcription factor RZR-alpha; ROR-alpha; RAR-related orphan receptor alpha [Homo sapiens]
[gi|19743905|ref|NP_599024.1|](#)[\[19743905\]](#)
- ☐ **34:** [NP_599023](#) BLink, Domains, Links
RAR-related orphan receptor A isoform a; retinoic acid receptor-related orphan receptor alpha; transcription factor RZR-alpha; ROR-alpha; RAR-related orphan receptor alpha [Homo sapiens]
[gi|19743903|ref|NP_599023.1|](#)[\[19743903\]](#)
- ☐ **35:** [NP_599022](#) BLink, Domains, Links
RAR-related orphan receptor A isoform b; retinoic acid receptor-related orphan receptor alpha; transcription factor RZR-alpha; ROR-alpha; RAR-related orphan receptor alpha [Homo sapiens]
[gi|19743901|ref|NP_599022.1|](#)[\[19743901\]](#)
- ☐ **36:** [NP_570716](#) BLink, Domains, Links
menin isoform 1; endocrine adenomatosis, multiple; Wermer syndrome; Zollinger-Ellison syndrome, included; menin [Homo sapiens]
[gi|18860857|ref|NP_570716.1|](#)[\[18860857\]](#)

☐ 37: [NP_570715](#)[BLink](#), [Domains](#), [Links](#)

menin isoform 1; endocrine adenomatosis, multiple; Wermer syndrome;
Zollinger-Ellison syndrome, included; menin [Homo sapiens]
gi|18860855|ref|NP_570715.1|[18860855]

☐ 38: [NP_570714](#)[BLink](#), [Domains](#), [Links](#)

menin isoform 1; endocrine adenomatosis, multiple; Wermer syndrome;
Zollinger-Ellison syndrome, included; menin [Homo sapiens]
gi|18860853|ref|NP_570714.1|[18860853]

☐ 39: [NP_570713](#)[BLink](#), [Domains](#), [Links](#)

menin isoform 1; endocrine adenomatosis, multiple; Wermer syndrome;
Zollinger-Ellison syndrome, included; menin [Homo sapiens]
gi|18860851|ref|NP_570713.1|[18860851]

☐ 40: [NP_570712](#)[BLink](#), [Domains](#), [Links](#)

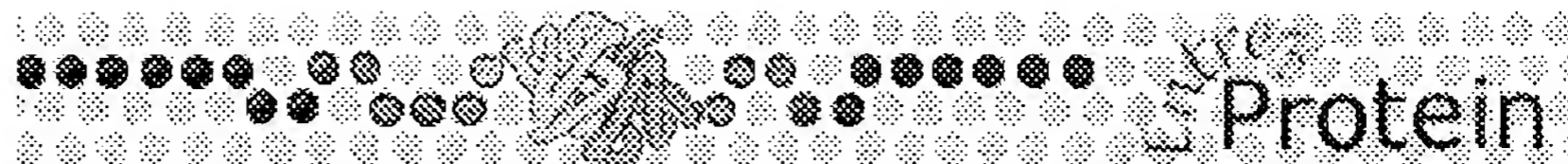
menin isoform 1; endocrine adenomatosis, multiple; Wermer syndrome;
Zollinger-Ellison syndrome, included; menin [Homo sapiens]
gi|18860849|ref|NP_570712.1|[18860849]

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menin isoform 2; endocrine adenomatosis, multiple; Wermer syndrome;
Zollinger-Ellison syndrome, included; menin [Homo sapiens]
[gi|18860847|ref|NP_570711.1|\[18860847\]](#)

Related resources

☐ **42: [NP_000235](#)**[BLink](#), [Domains](#), [Links](#)

menin isoform 1; endocrine adenomatosis, multiple; Wermer syndrome;
Zollinger-Ellison syndrome, included; menin [Homo sapiens]
[gi|18860839|ref|NP_000235.2|\[18860839\]](#)

☐ **43: [NP_571004](#)**[BLink](#), [Domains](#), [Links](#)

nucleoside diphosphate kinase-Z4 [Danio rerio]
[gi|18859073|ref|NP_571004.1|\[18859073\]](#)

☐ **44: [NP_571003](#)**[BLink](#), [Domains](#), [Links](#)

nucleoside diphosphate kinase-Z3 [Danio rerio]
[gi|18859071|ref|NP_571003.1|\[18859071\]](#)

☐ **45: [NP_542368](#)**[BLink](#), [Domains](#), [Links](#)

expressed in non-metastatic cells 5 [Mus musculus]
[gi|18079349|ref|NP_542368.1|\[18079349\]](#)

☐ **46: [NP_445959](#)**[BLink](#), [Domains](#), [Links](#)

expressed in non-metastatic cells 3 [Rattus norvegicus]
[gi|16758266|ref|NP_445959.1|\[16758266\]](#)

☐ **47: [NP_002458](#)**[BLink](#), [Domains](#), [Links](#)

v-myc myelocytomatosis viral oncogene homolog; v-myc avian
myelocytomatosis viral oncogene homolog [Homo sapiens]
[gi|12962935|ref|NP_002458.1|\[12962935\]](#)

☐ **48: [NP_008839](#)**[BLink](#), [Domains](#), [Links](#)

ras-related C3 botulinum toxin substrate 1 isoform Rac1; rho family, small

GTP binding protein Rac1 [Homo sapiens]
gi|9845511|ref|NP_008839.2|[9845511]

- ☐ **49:** [NP_061485](#) BLink, Domains, Links
ras-related C3 botulinum toxin substrate 1 isoform Rac1b; rho family, small
GTP binding protein Rac1 [Homo sapiens]
gi|9845509|ref|NP_061485.1|[9845509]
- ☐ **50:** [NP_062705](#) BLink, Domains, Links
nucleoside diphosphate kinase 4; nucleoside diphosphate kinase [Mus
musculus]
gi|9790123|ref|NP_062705.1|[9790123]
- ☐ **51:** [NP_062704](#) BLink, Domains, Links
nucleoside diphosphate kinase DR-nm23 [Mus musculus]
gi|9790121|ref|NP_062704.1|[9790121]
- ☐ **52:** [NP_061227](#) BLink, Domains, Links
expressed in non-metastatic cells 6, protein; nucleoside diphosphate kinase
type 6; nm23/nucleoside diphosphate kinase 6; expressed in non-metastatic
cells 6, protein (nucleoside diphosphate kinase) [Mus musculus]
gi|9055290|ref|NP_061227.1|[9055290]
- ☐ **53:** [NP_000537](#) BLink, Domains, Links
tumor protein p53 [Homo sapiens]
gi|8400738|ref|NP_000537.2|[8400738]
- ☐ **54:** [NP_038599](#) BLink, Domains, Links
kinase suppressor of ras [Mus musculus]
gi|7305215|ref|NP_038599.1|[7305215]
- ☐ **55:** [NP_032731](#) BLink, Domains, Links
nucleoside-diphosphate kinase 2; nucleoside diphosphate kinase B [Mus
musculus]
gi|6679078|ref|NP_032731.1|[6679078]
- ☐ **56:** [NP_006370](#) BLink, Domains, Links
semaphorin 3C; semaphorin E [Homo sapiens]
gi|5454048|ref|NP_006370.1|[5454048]
- ☐ **57:** [NP_005000](#) BLink, Domains, Links
nucleoside-diphosphate kinase 4 [Homo sapiens]
gi|4826862|ref|NP_005000.1|[4826862]
- ☐ **58:** [NP_004439](#) BLink, Domains, Links
v-erb-b2 erythroblastic leukemia viral oncogene homolog 2,
neuro/glioblastoma derived oncogene homolog; Avian erythroblastic

leukemia viral (v-erb-b2) oncogene homolog 2; v-erb-b2 avian erythroblastic
leukemia viral oncogene homolog 2 (neuro/glioblastoma derived oncogene
homolog) [Homo sapiens]
gi|4758298|ref|NP_004439.1|[4758298]

☐ **59:** [NP_000260](#)

[BLink](#), [Domains](#), [Links](#)

nucleoside-diphosphate kinase 1 isoform b [Homo sapiens]
gi|4557797|ref|NP_000260.1|[4557797]

☐ **60:** [NP_001051](#)

[BLink](#), [Domains](#), [Links](#)

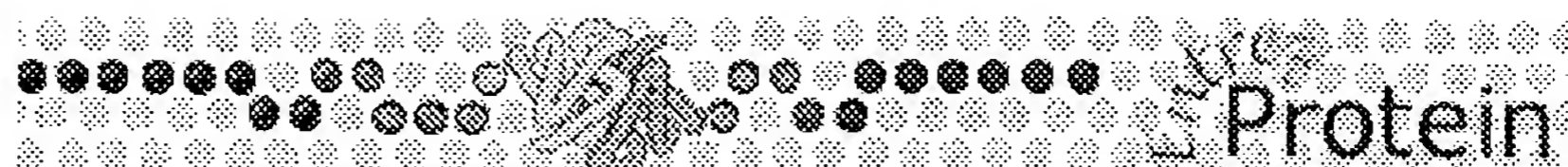
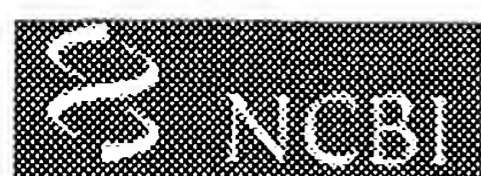
thromboxane A2 receptor isoform 2 [Homo sapiens]
gi|4507381|ref|NP_001051.1|[4507381]

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Entrez	PubMed	Nucleotide	Protein	Genome	Structure	PMC	Taxonomy	Books
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Related resources

- ☐ **61: NP_002934** BLink, Domains, Links
RAR-related orphan receptor A isoform c; retinoic acid receptor-related orphan receptor alpha; transcription factor RZR-alpha; ROR-alpha; RAR-related orphan receptor alpha [Homo sapiens]
gi|4506577|ref|NP_002934.1|[4506577]
- ☐ **62: NP_000954** BLink, Domains, Links
prostaglandin-endoperoxide synthase 2 precursor; prostaglandin G/H synthase and cyclooxygenase [Homo sapiens]
gi|4506265|ref|NP_000954.1|[4506265]
- ☐ **63: NP_002583** BLink, Domains, Links
proliferating cell nuclear antigen; cyclin; DNA polymerase delta auxiliary protein [Homo sapiens]
gi|4505641|ref|NP_002583.1|[4505641]
- ☐ **64: NP_003542** BLink, Domains, Links
non-metastatic cells 5, protein expressed in (nucleoside-diphosphate kinase) [Homo sapiens]
gi|4505413|ref|NP_003542.1|[4505413]
- ☐ **65: NP_002503** BLink, Domains, Links
nucleoside-diphosphate kinase 2; non-metastatic cells 2, protein (NM23) expressed in; c-myc transcription factor [Homo sapiens]
gi|4505409|ref|NP_002503.1|[4505409]
- ☐ **66: NP_002414** BLink, Domains, Links
matrix metalloproteinase 7 preproprotein; matrin; uterine matrilysin [Homo sapiens]
gi|4505219|ref|NP_002414.1|[4505219]
- ☐ **67: NP_005784** BLink, Domains, Links
nucleoside diphosphate kinase type 6; inhibitor of p53-induced apoptosis-alpha [Homo sapiens]

gi|5031951|ref|NP_005784.1|[5031951]

☐ **68:** NP_067045

[BLink](#), [Domains](#), [Links](#)

TcD37 homolog; prune [Homo sapiens]
gi|24308263|ref|NP_067045.1|[24308263]

☐ **69:** NP_006401

[BLink](#), [Domains](#), [Links](#)

HIV-1 Tat interactive protein 2, 30kDa; Tat-interacting protein (30kD);
HIV-1 Tat interactive protein 2, 30 kDa; HIV-1 Tat interactive protein 2, 30
kD [Homo sapiens]
gi|20127503|ref|NP_006401.2|[20127503]

☐ **70:** NP_002408

[BLink](#), [Domains](#), [Links](#)

antigen identified by monoclonal antibody Ki-67; Proliferation-related Ki-67
antigen [Homo sapiens]
gi|19923217|ref|NP_002408.2|[19923217]

☐ **71:** NP_112316

[BLink](#), [Domains](#), [Links](#)

matrix metalloproteinase 2 (72 KDa type IV collagenase); gelatinase A
[Rattus norvegicus]
gi|13591991|ref|NP_112316.1|[13591991]

☐ **72:** NP_006656

[BLink](#), [Domains](#), [Links](#)

heparanase; heparanase-1 [Homo sapiens]
gi|5729873|ref|NP_006656.1|[5729873]

☐ **73:** XP_377976

[BLink](#), [Links](#)

PREDICTED: similar to Nucleoside diphosphate kinase, mitochondrial
precursor (NDP kinase, mitochondrial) (NDK) (nm23-H4) (Nucleoside
diphosphate kinase D) (NDPKD) [Homo sapiens]
gi|51466625|ref|XP_377976.2|[51466625]

☐ **74:** EAL24027

[BLink](#), [Links](#)

similar to Nucleoside diphosphate kinase, mitochondrial precursor (NDP
kinase, mitochondrial) (NDK) (nm23-M4) (Nucleoside diphosphate kinase
D) [Homo sapiens]
gi|51094781|gb|EAL24027.1|[51094781]

☐ **75:** XP_424348

[BLink](#), [Links](#)

PREDICTED: similar to Nucleoside diphosphate kinase homolog 5 (NDK-H
5) (NDP kinase homolog 5) (nm23-H5) (Testis-specific nm23 homolog)
(Inhibitor of p53-induced apoptosis-beta) (IPIA-beta) [Gallus gallus]
gi|50805547|ref|XP_424348.1|[50805547]

☐ **76:** XP_417888

[BLink](#), [Links](#)

PREDICTED: similar to nm23-phosphorylated unknown substrate; SH3
domain-containing 70 kDa protein [Gallus gallus]

gi|50760071|ref|XP_417888.1|[50760071]

☐ 77: [XP_414687](#)

[BLink](#), [Links](#)

PREDICTED: similar to Nucleoside diphosphate kinase homolog 5 (NDK-H 5) (NDP kinase homolog 5) (nm23-H5) (Testis-specific nm23 homolog) (Inhibitor of p53-induced apoptosis-beta) (IPIA-beta) [Gallus gallus]
gi|50755299|ref|XP_414687.1|[50755299]

☐ 78: [XP_426021](#)

[BLink](#), [Links](#)

PREDICTED: similar to NM23-H8; sperm-specific thioredoxin 2; thioredoxin domain-containing 3 (spermatozoa) [Gallus gallus]
gi|50733086|ref|XP_426021.1|[50733086]

☐ 79: [XP_416591](#)

[BLink](#), [Links](#)

PREDICTED: similar to Nucleoside diphosphate kinase 7 (NDK 7) (NDP kinase 7) (nm23-H7) [Gallus gallus]
gi|50729630|ref|XP_416591.1|[50729630]

☐ 80: [AAH36816](#)

[BLink](#), [Domains](#), [MGC cDNA clone](#), [Links](#)

NM23-H8 [Homo sapiens]
gi|22477642|gb|AAH36816.1|[22477642]

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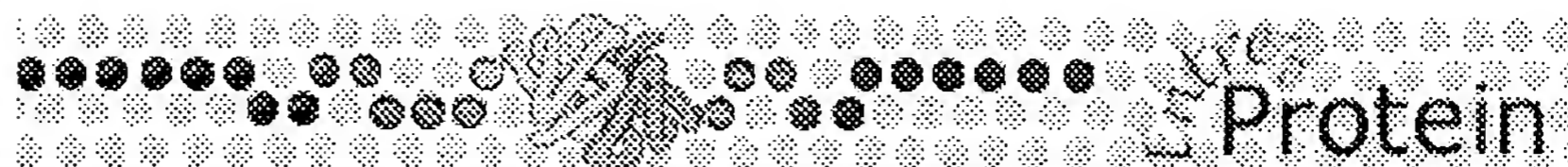
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☐ **81: [AAH28503](#)** BLink, Domains, MGC cDNA clone, Links
Nucleoside diphosphate kinase DR-nm23 [Mus musculus]
gi|20306984|gb|AAH28503.1|[20306984]

Related resources

☐ **82: [AAH18994](#)** BLink, Domains, MGC cDNA clone, Links
Nucleoside-diphosphate kinase 1, isoform b [Homo sapiens]
gi|17512044|gb|AAH18994.1|[17512044]

☐ **83: [AAH00293](#)** BLink, Domains, MGC cDNA clone, Links
Nucleoside-diphosphate kinase 1, isoform b [Homo sapiens]
gi|12653057|gb|AAH00293.1|[12653057]

☐ **84: [Q01105](#)** BLink, Domains, Links
SET protein (Phosphatase 2A inhibitor I2PP2A) (I-2PP2A) (Template activating factor I) (TAF-I) (HLA-DR associated protein II) (PHAPII) (Inhibitor of granzyme A-activated DNase) (IGAAD)
gi|46397790|sp|Q01105|SET_HUMAN[46397790]

☐ **85: [Q13232](#)** BLink, Domains, Links
Nucleoside diphosphate kinase 3 (NDK 3) (NDP kinase 3) (Nucleoside diphosphate kinase C) (NDPKC) (nm23-H3) (DR-nm23)
gi|21264477|sp|Q13232|NDK3_HUMAN[21264477]

☐ **86: [Q9WV84](#)** BLink, Domains, Links
Nucleoside diphosphate kinase, mitochondrial precursor (NDP kinase, mitochondrial) (NDK) (nm23-M4) (Nucleoside diphosphate kinase D) (NDPKD)
gi|12230351|sp|Q9WV84|NDKM_MOUSE[12230351]

☐ **87: [Q01768](#)** BLink, Domains, Links
Nucleoside diphosphate kinase B (NDK B) (NDP kinase B) (nm23-M2) (P18)
gi|266608|sp|Q01768|NDKB_MOUSE[266608]

- ☐ **88:** [P15532](#) BLink, Domains, Links
Nucleoside diphosphate kinase A (NDK A) (NDP kinase A) (Tumor metastatic process-associated protein) (Metastasis inhibition factor NM23) (NDPK-A) (nm23-M1)
gi|127982|sp|P15532|NDKA_MOUSE[127982]
- ☐ **89:** [XP_396235](#) BLink, Domains, Links
similar to Nucleoside diphosphate kinase 7 (NDK 7) (NDP kinase 7) (nm23-R7) [Apis mellifera]
gi|48109475|ref|XP_396235.1|[48109475]
- ☐ **90:** [XP_396140](#) BLink, Domains, Links
similar to Nucleoside diphosphate kinase 6 (NDK 6) (NDP kinase 6) (nm23-H6) (Inhibitor of p53-induced apoptosis-alpha) (IPIA-alpha) [Apis mellifera]
gi|48106672|ref|XP_396140.1|[48106672]
- ☐ **91:** [XP_394702](#) BLink, Domains, Links
similar to Nucleoside diphosphate kinase homolog 5 (NDK-H 5) (NDP kinase homolog 5) (nm23-H5) (Testis-specific nm23 homolog) (Inhibitor of p53-induced apoptosis-beta) (IPIA-beta) [Apis mellifera]
gi|48096513|ref|XP_394702.1|[48096513]
- ☐ **92:** [XP_394464](#) BLink, Domains, Links
similar to multiple endocrine neoplasia type 1 [Apis mellifera]
gi|48095533|ref|XP_394464.1|[48095533]
- ☐ **93:** [Q9WV85](#) BLink, Domains, Links
Nucleoside diphosphate kinase 3 (NDK 3) (NDP kinase 3) (Nucleoside diphosphate kinase C) (NDPKC) (nm23-M3) (DR-nm23)
gi|48429268|sp|Q9WV85|NDK3_MOUSE[48429268]
- ☐ **94:** [AAH02664](#) BLink, Domains, Links
MEN1 protein [Homo sapiens]
gi|38197214|gb|AAH02664.2|[38197214]
- ☐ **95:** [AAH33449](#) BLink, Domains, MGC cDNA clone, Links
Rgs3 protein [Mus musculus]
gi|23270966|gb|AAH33449.1|[23270966]
- ☐ **96:** [NP_996468](#) BLink, Domains, Links
CG18102-PA [Drosophila melanogaster]
gi|45555521|ref|NP_996468.1|[45555521]
- ☐ **97:** [NP_996467](#) BLink, Domains, Links
CG18102-PE [Drosophila melanogaster]
gi|45555505|ref|NP_996467.1|[45555505]

☐ **98:** [NP_996466](#)[BLink](#), [Domains](#), [Links](#)

CG18102-PF [Drosophila melanogaster]
gi|45555485|ref|NP_996466.1|[45555485]

☐ **99:** [NP_996465](#)[BLink](#), [Domains](#), [Links](#)

CG18102-PG [Drosophila melanogaster]
gi|45555473|ref|NP_996465.1|[45555473]

☐ **100:** [NP_995619](#)[BLink](#), [Domains](#), [Links](#)

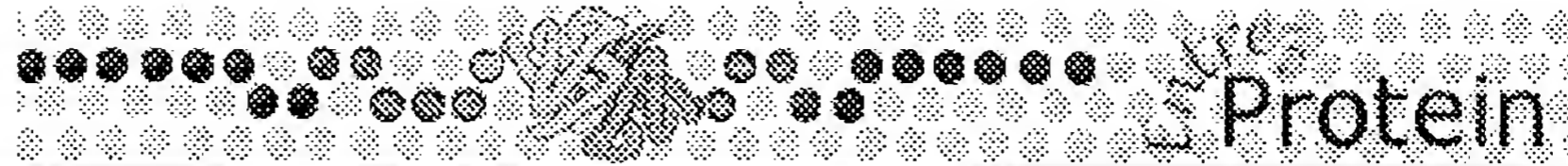
CG3139-PD [Drosophila melanogaster]
gi|45552193|ref|NP_995619.1|[45552193]

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Entrez	PubMed	Nucleotide	Protein	Genome	Structure	PMC	Taxonomy	Books
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 of 13 Next☐ **101:** [NP_730714](#)[BLink](#), [Domains](#), [Links](#)

CG6395-PC [Drosophila melanogaster]
gi|28574723|ref|NP_730714.2|[28574723]

Related resources

☐ **102:** [NP_730713](#)[BLink](#), [Domains](#), [Links](#)

CG6395-PB [Drosophila melanogaster]
gi|24668523|ref|NP_730713.1|[24668523]

☐ **103:** [NP_729956](#)[BLink](#), [Domains](#), [Links](#)

CG32134-PA [Drosophila melanogaster]
gi|24664073|ref|NP_729956.1|[24664073]

☐ **104:** [NP_732412](#)[BLink](#), [Domains](#), [Links](#)

CG3619-PB [Drosophila melanogaster]
gi|24648166|ref|NP_732412.1|[24648166]

☐ **105:** [NP_727911](#)[BLink](#), [Domains](#), [Links](#)

CG18102-PB [Drosophila melanogaster]
gi|24642338|ref|NP_727911.1|[24642338]

☐ **106:** [NP_727910](#)[BLink](#), [Domains](#), [Links](#)

CG18102-PD [Drosophila melanogaster]
gi|24642336|ref|NP_727910.1|[24642336]

☐ **107:** [NP_722839](#)[BLink](#), [Domains](#), [Links](#)

CG3139-PC [Drosophila melanogaster]
gi|24581228|ref|NP_722839.1|[24581228]

☐ **108:** [NP_722838](#)[BLink](#), [Domains](#), [Links](#)

CG3139-PB [Drosophila melanogaster]
gi|24581226|ref|NP_722838.1|[24581226]

☐ **109:** [NP_722587](#)[BLink](#), [Links](#)

CG2671-PF [Drosophila melanogaster]
gi|24580507|ref|NP_722587.1|[24580507]

☐ **110:** NP_722586

BLink, Links

CG2671-PE [Drosophila melanogaster]
gi|24580505|ref|NP_722586.1|[24580505]

☐ **111:** NP_722585

BLink, Links

CG2671-PD [Drosophila melanogaster]
gi|24580503|ref|NP_722585.1|[24580503]

☐ **112:** NP_722584

BLink, Links

CG2671-PA [Drosophila melanogaster]
gi|24464586|ref|NP_722584.1|[24464586]

☐ **113:** NP_722583

BLink, Links

CG2671-PB [Drosophila melanogaster]
gi|24464584|ref|NP_722583.1|[24464584]

☐ **114:** NP_523485

BLink, Domains, Links

CG7234-PI [Drosophila melanogaster]
gi|45549153|ref|NP_523485.3|[45549153]

☐ **115:** NP_476761

BLink, Domains, Links

CG2210-PA [Drosophila melanogaster]
gi|45549037|ref|NP_476761.2|[45549037]

☐ **116:** NP_523872

BLink, Domains, Links

CG6883-PA [Drosophila melanogaster]
gi|24654763|ref|NP_523872.2|[24654763]

☐ **117:** NP_523371

BLink, Domains, Links

CG9907-PA [Drosophila melanogaster]
gi|24642537|ref|NP_523371.2|[24642537]

☐ **118:** NP_524853

BLink, Domains, Links

CG18102-PC [Drosophila melanogaster]
gi|24642340|ref|NP_524853.2|[24642340]

☐ **119:** NP_511119

BLink, Domains, Links

CG1594-PA [Drosophila melanogaster]
gi|24641273|ref|NP_511119.2|[24641273]

☐ **120:** NP_476859

BLink, Domains, Links

CG3936-PA [Drosophila melanogaster]
gi|24639454|ref|NP_476859.2|[24639454]

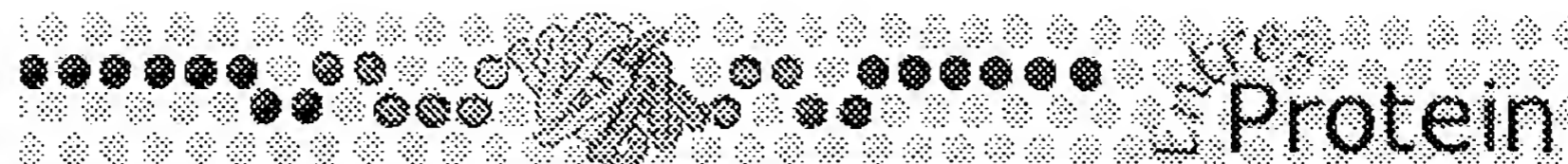
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CG3139-PA [Drosophila melanogaster]
gi|24581230|ref|NP_523460.2|[24581230]

Related resources

☐ **122:** [NP_523439](#)[BLink](#), [Links](#)

CG2671-PC [Drosophila melanogaster]
gi|24580501|ref|NP_523439.2|[24580501]

☐ **123:** [NP_524877](#)[BLink](#), [Domains](#), [Links](#)

CG1618-PA [Drosophila melanogaster]
gi|17864540|ref|NP_524877.1|[17864540]

☐ **124:** [NP_524213](#)[BLink](#), [Domains](#), [Links](#)

CG6395-PA [Drosophila melanogaster]
gi|17737735|ref|NP_524213.1|[17737735]

☐ **125:** [NP_477323](#)[BLink](#), [Domains](#), [Links](#)

CG1099-PB [Drosophila melanogaster]
gi|17137490|ref|NP_477323.1|[17137490]

☐ **126:** [NP_477322](#)[BLink](#), [Domains](#), [Links](#)

CG1099-PA [Drosophila melanogaster]
gi|17137488|ref|NP_477322.1|[17137488]

☐ **127:** [NP_477264](#)[BLink](#), [Domains](#), [Links](#)

CG3619-PA [Drosophila melanogaster]
gi|17137388|ref|NP_477264.1|[17137388]

☐ **128:** [NP_476874](#)[BLink](#), [Domains](#), [Links](#)

CG5920-PA [Drosophila melanogaster]
gi|17136734|ref|NP_476874.1|[17136734]

☐ **129:** [NP_476792](#)[BLink](#), [Domains](#), [Links](#)

CG3757-PA [Drosophila melanogaster]
gi|17136600|ref|NP_476792.1|[17136600]

☐ **130:** NP_476759

BLink, Domains, Links

CG10079-PB [Drosophila melanogaster]
gi|17136536|ref|NP_476759.1|[17136536]

☐ **131:** NP_476758

BLink, Domains, Links

CG10079-PA [Drosophila melanogaster]
gi|17136534|ref|NP_476758.1|[17136534]

☐ **132:** NP_476684

BLink, Domains, Links

CG3461-PA [Drosophila melanogaster]
gi|17136406|ref|NP_476684.1|[17136406]

☐ **133:** Q05982

BLink, Domains, Links

Nucleoside diphosphate kinase A (NDK A) (NDP kinase A) (Tumor metastatic process-associated protein) (Metastasis inhibition factor NM23)
gi|462690|sp|Q05982|NDKA_RAT[462690]

☐ **134:** BAC39392

BLink, Domains, Links

unnamed protein product [Mus musculus]
gi|26351511|dbj|BAC39392.1|[26351511]

☐ **135:** BAB30896

BLink, Domains, Links

unnamed protein product [Mus musculus]
gi|12857112|dbj|BAB30896.1|[12857112]

☐ **136:** BAB27708

BLink, Links

unnamed protein product [Mus musculus]
gi|12847786|dbj|BAB27708.1|[12847786]

☐ **137:** NP_173184

BLink, Domains, Links

nucleoside diphosphate kinase family protein [Arabidopsis thaliana]
gi|42562123|ref|NP_173184.2|[42562123]

☐ **138:** O75414

BLink, Domains, Links

Nucleoside diphosphate kinase 6 (NDK 6) (NDP kinase 6) (nm23-H6) (Inhibitor of p53-induced apoptosis-alpha) (IPIA-alpha)
gi|12232627|sp|O75414|NDK6_HUMAN[12232627]

☐ **139:** NP_508832

BLink, Domains, Links

nm23-phosphorylated substrate (XF511) [Caenorhabditis elegans]
gi|17569663|ref|NP_508832.1|[17569663]

☐ **140:** AAQ77892

BLink, Links

Sequence 5 from patent US 6329198

gi|34599178|gb|AAQ77892.1||pat|US|6329198|5[34599178]

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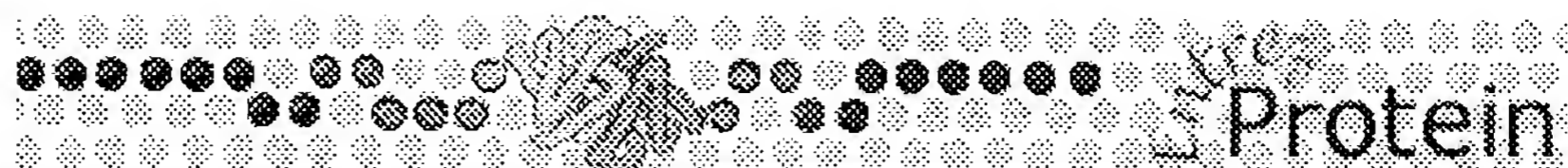
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Sequence 4 from patent US 6329198
gi|34599177|gb|AAQ77891.1||pat|US|6329198|4[34599177]

Related resources

☐ **142: [AAQ77890](#)**[BLink](#), [Links](#)

Sequence 2 from patent US 6329198
gi|34599176|gb|AAQ77890.1||pat|US|6329198|2[34599176]

☐ **143: [AAQ77889](#)**[BLink](#), [Links](#)

Sequence 1 from patent US 6329198
gi|34599175|gb|AAQ77889.1||pat|US|6329198|1[34599175]

☐ **144: [Q99MH5](#)**[BLink](#), [Domains](#), [Links](#)

Nucleoside diphosphate kinase homolog 5 (NDK-H 5) (NDP kinase homolog 5) (nm23-M5)
gi|32700087|sp|Q99MH5|NDK5_MOUSE[32700087]

☐ **145: [P56597](#)**[BLink](#), [Domains](#), [Links](#)

Nucleoside diphosphate kinase homolog 5 (NDK-H 5) (NDP kinase homolog 5) (nm23-H5) (Testis-specific nm23 homolog) (Inhibitor of p53-induced apoptosis-beta) (IPIA-beta)
gi|3914118|sp|P56597|NDK5_HUMAN[3914118]

☐ **146: [O88425](#)**[BLink](#), [Domains](#), [Links](#)

Nucleoside diphosphate kinase 6 (NDK 6) (NDP kinase 6) (nm23-M6)
gi|12230337|sp|O88425|NDK6_MOUSE[12230337]

☐ **147: [AH003706](#)**[Links](#)

nucleotide diphosphate kinase subunit A; p19/nm23-H1 [Homo sapiens]
gi|1619637|gb|AH003706.1||bbm|131421[1619637]

☐ **148: [AAB19266](#)**[Links](#)

nucleotide diphosphate kinase subunit A, p19/nm23-H1 [human, Peptide]

Partial, 6 aa, segment 3 of 3]

gi|232476|gb|AAB19266.1||bbs|38818[232476]

☐ **149:** AAB19265

[Links](#)

No definition line found

gi|232475|gb|AAB19265.1||bbs|38817[232475]

☐ **150:** AAB19264

[Links](#)

nucleotide diphosphate kinase subunit A, p19/nm23-H1 [human, Peptide
Partial, 10 aa, segment 2 of 3]

gi|232474|gb|AAB19264.1||bbs|38815[232474]

☐ **151:** AAB19263

[Links](#)

No definition line found

gi|232473|gb|AAB19263.1||bbs|38813[232473]

☐ **152:** AAB19262

[Links](#)

nucleotide diphosphate kinase subunit A, p19/nm23-H1 [human, Peptide
Partial, 12 aa, segment 1 of 3]

gi|232472|gb|AAB19262.1||bbs|38811[232472]

☐ **153:** AAO85436

[BLink](#), [Domains](#), [Links](#)

NM23-H1 [Homo sapiens]

gi|29468184|gb|AAO85436.1|AF487339_1[29468184]

☐ **154:** AAC95290

[BLink](#), [Domains](#), [Links](#)

PRUNE-like protein [Homo sapiens]

gi|4007408|gb|AAC95290.1|[4007408]

☐ **155:** 1JXVF

[BLink](#), [Domains](#), [Links](#)

Chain F, Crystal Structure Of Human Nucleoside Diphosphate Kinase A

gi|20663972|pdb|1JXV|F[20663972]

☐ **156:** 1JXVE

[BLink](#), [Domains](#), [Links](#)

Chain E, Crystal Structure Of Human Nucleoside Diphosphate Kinase A

gi|20663971|pdb|1JXV|E[20663971]

☐ **157:** 1JXVD

[BLink](#), [Domains](#), [Links](#)

Chain D, Crystal Structure Of Human Nucleoside Diphosphate Kinase A

gi|20663970|pdb|1JXV|D[20663970]

☐ **158:** 1JXVC

[BLink](#), [Domains](#), [Links](#)

Chain C, Crystal Structure Of Human Nucleoside Diphosphate Kinase A

gi|20663969|pdb|1JXV|C[20663969]

☐ **159:** 1JXVB

[BLink](#), [Domains](#), [Links](#)

Chain B, Crystal Structure Of Human Nucleoside Diphosphate Kinase A

gi|20663968|pdb|1JXV|B[20663968]

☐ **160:** 1JXVA

[BLink](#), [Domains](#), [Links](#)

Chain A, Crystal Structure Of Human Nucleoside Diphosphate Kinase A
gi|20663967|pdb|1JXV|A[20663967]

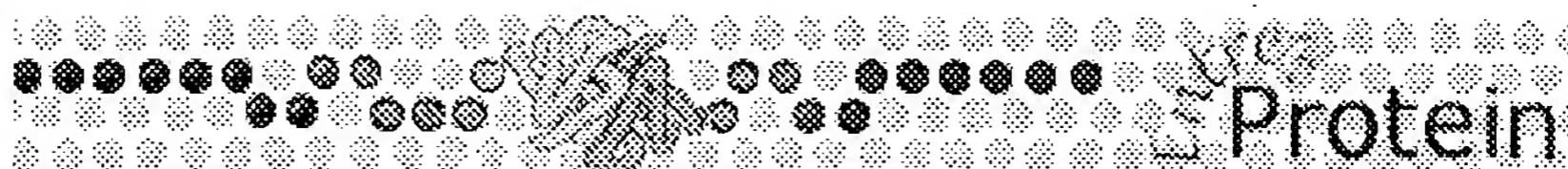
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Sequence 5 from patent US 6486300
gi|27307281|gb|AAO00061.1||pat|US|6486300|5[27307281]

Related resources

☐ **162:** [AAO00060](#)[BLink](#), [Links](#)

Sequence 4 from patent US 6486300
gi|27307280|gb|AAO00060.1||pat|US|6486300|4[27307280]

☐ **163:** [AAO00059](#)[BLink](#), [Links](#)

Sequence 3 from patent US 6486300
gi|27307279|gb|AAO00059.1||pat|US|6486300|3[27307279]

☐ **164:** [AAO00058](#)[BLink](#), [Links](#)

Sequence 1 from patent US 6486300
gi|27307278|gb|AAO00058.1||pat|US|6486300|1[27307278]

☐ **165:** [A49798](#)[BLink](#), [Domains](#), [Links](#)

nucleoside-diphosphate kinase (EC 2.7.4.6) nm23-H2 - human
gi|7434617|pir||A49798[7434617]

☐ **166:** [I39074](#)[BLink](#), [Domains](#), [Links](#)

nucleoside-diphosphate kinase (EC 2.7.4.6) DR-nm23 - human
gi|2135180|pir||I39074[2135180]

☐ **167:** [S47563](#)[BLink](#), [Links](#)

nucleoside-diphosphate kinase (EC 2.7.4.6) - oat (fragment)
gi|1076713|pir||S47563[1076713]

☐ **168:** [A46557](#)[BLink](#), [Domains](#), [Links](#)

nucleoside-diphosphate kinase (EC 2.7.4.6) - mouse (fragment)
gi|482449|pir||A46557[482449]

☐ **169:** [S29241](#)[BLink](#), [Domains](#), [Links](#)

nucleoside-diphosphate kinase (EC 2.7.4.6) B - mouse
gi|478765|pir||S29241[478765]

☐ **170:** [A33386](#) BLink, Domains, Links

nucleoside-diphosphate kinase (EC 2.7.4.6) nm23-H1g - human
gi|88268|pir||A33386[88268]

☐ **171:** [AAG02202](#) BLink, Domains, Links

nucleoside diphosphate kinase D [Mus musculus]
gi|9931518|gb|AAG02202.1|AF288692_1[9931518]

☐ **172:** [AAG02201](#) BLink, Domains, Links

nucleoside diphosphate kinase C [Mus musculus]
gi|9931516|gb|AAG02201.1|AF288691_1[9931516]

☐ **173:** [AAG02200](#) BLink, Domains, Links

nucleoside diphosphate kinase D [Mus musculus]
gi|9931514|gb|AAG02200.1|AF288690_1[9931514]

☐ **174:** [AAG02199](#) BLink, Domains, Links

nucleoside diphosphate kinase C [Mus musculus]
gi|9931512|gb|AAG02199.1|AF288689_1[9931512]

☐ **175:** [AAN23827](#) BLink, Links

Sequence 3 from patent US 6423836
gi|23325147|gb|AAN23827.1||pat|US|6423836|3[23325147]

☐ **176:** [AAN23826](#) BLink, Links

Sequence 1 from patent US 6423836
gi|23325146|gb|AAN23826.1||pat|US|6423836|1[23325146]

☐ **177:** [O88426](#) BLink, Domains, Links

Nucleoside diphosphate kinase 6 (NDK 6) (NDP kinase 6) (nm23-R6)
gi|12230330|sp|O88426|NDK6_RAT[12230330]

☐ **178:** [AAL16953](#) BLink, Domains, Links

nm23-phosphorylated unknown substrate [Homo sapiens]
gi|16304176|gb|AAL16953.1|AF425252_1[16304176]

☐ **179:** [AAF74448](#) BLink, Domains, Links

nucleoside diphosphate kinase NDPK-Z6 [Danio rerio]
gi|8308035|gb|AAF74448.1|AF241153_1[8308035]

☐ **180:** [AAF60971](#) BLink, Domains, Links

nucleoside diphosphate kinase B [Danio rerio]
gi|7339840|gb|AAF60971.1|AF201764_1[7339840]

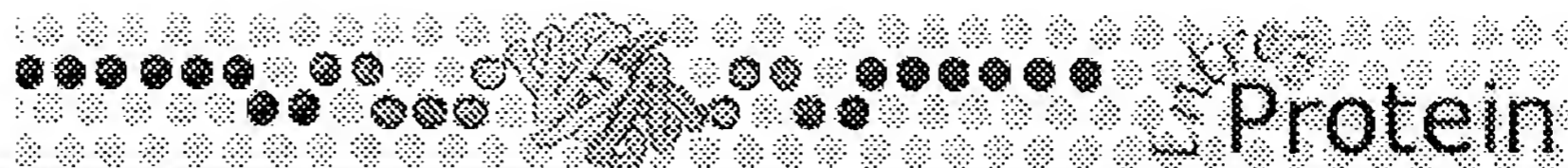
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Search	Protein	<input type="checkbox"/> for nm23 or nm23H1 or nm23H2					Go	Clear
		Limits	Preview/Index	History	Clipboard	Details		

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Previous Page 10 of 13 Next☐ **181: [AAF20913](#)**[BLink](#), [Domains](#), [Links](#)

nucleoside diphosphate kinase Z7 [Danio rerio]
gi|6644117|gb|AAF20913.1|AF202055_1[6644117]

Related resources

☐ **182: [AAF20912](#)**[BLink](#), [Domains](#), [Links](#)

nucleoside diphosphate kinase-Z3 [Danio rerio]
gi|6644115|gb|AAF20912.1|AF202054_1[6644115]

☐ **183: [AAF20911](#)**[BLink](#), [Domains](#), [Links](#)

nucleoside diphosphate kinase-Z2 [Danio rerio]
gi|6644113|gb|AAF20911.1|AF202053_1[6644113]

☐ **184: [AAF20910](#)**[BLink](#), [Domains](#), [Links](#)

nucleoside diphosphate kinase-Z1 [Danio rerio]
gi|6644111|gb|AAF20910.1|AF202052_1[6644111]

☐ **185: [AAE45610](#)**[BLink](#), [Links](#)

Sequence 5 from patent US 6087125
gi|12815801|gb|AAE45610.1||pat|US|6087125|5[12815801]

☐ **186: [AAE45609](#)**[BLink](#), [Links](#)

Sequence 4 from patent US 6087125
gi|12815800|gb|AAE45609.1||pat|US|6087125|4[12815800]

☐ **187: [AAE45608](#)**[BLink](#), [Links](#)

Sequence 3 from patent US 6087125
gi|12815799|gb|AAE45608.1||pat|US|6087125|3[12815799]

☐ **188: [AAE45607](#)**[BLink](#), [Links](#)

Sequence 1 from patent US 6087125
gi|12815798|gb|AAE45607.1||pat|US|6087125|1[12815798]

☐ **189: [AAK00527](#)**[BLink](#), [Domains](#), [Links](#)

nucleoside diphosphate kinase A [*Cavia porcellus*]
gi|12700713|gb|AAK00527.1|[12700713]

☐ **190:** [AAG54075](#)

[BLink](#), [Domains](#), [Links](#)

nucleoside diphosphate kinase DR-nm23 [*Rattus norvegicus*]
gi|12621064|gb|AAG54075.1|[12621064]

☐ **191:** [AAG14350](#)

[BLink](#), [Domains](#), [Links](#)

putative oncoprotein nm23 [*Ictalurus punctatus*]
gi|10180968|gb|AAG14350.1|AF283993_1|[10180968]

☐ **192:** [1EHWB](#)

[BLink](#), [Domains](#), [Links](#)

Chain B, Human Nucleoside Diphosphate Kinase 4
gi|8569509|pdb|1EHW|B[8569509]

☐ **193:** [1EHWA](#)

[BLink](#), [Domains](#), [Links](#)

Chain A, Human Nucleoside Diphosphate Kinase 4
gi|8569508|pdb|1EHW|A[8569508]

☐ **194:** [P70011](#)

[BLink](#), [Domains](#), [Links](#)

NUCLEOSIDE DIPHOSPHATE KINASE A2 (NDK A2) (NDP KINASE
A2) (NM23/NUCLEOSIDE DIPHOSPHATE KINASE A2)
gi|6225752|sp|P70011|NDK2_XENLA[6225752]

☐ **195:** [P70010](#)

[BLink](#), [Domains](#), [Links](#)

NUCLEOSIDE DIPHOSPHATE KINASE A1 (NDK A1) (NDP KINASE
A1) (NM23/NUCLEOSIDE DIPHOSPHATE KINASE A1)
gi|6225751|sp|P70010|NDK1_XENLA[6225751]

☐ **196:** [AAF64467](#)

[BLink](#), [Domains](#), [Links](#)

type 6 nucleoside diphosphate kinase [*Drosophila melanogaster*]
gi|7595825|gb|AAF64467.1|AF241151_1[7595825]

☐ **197:** [AAF20909](#)

[BLink](#), [Domains](#), [Links](#)

NM23-H8 [*Homo sapiens*]
gi|7580490|gb|AAF20909.2|AF202051_1[7580490]

☐ **198:** [AAD34622](#)

[BLink](#), [Domains](#), [Links](#)

nm23-H7 [*Homo sapiens*]
gi|4960169|gb|AAD34622.1|AF153191_1[4960169]

☐ **199:** [AAF20908](#)

[BLink](#), [Domains](#), [Links](#)

nmdyn-D7 [*Drosophila melanogaster*]
gi|6644107|gb|AAF20908.1|AF202050_1[6644107]

☐ **200:** [AAF20907](#)

[BLink](#), [Domains](#), [Links](#)

NM23-R7 [*Rattus norvegicus*]

gi|6644105|gb|AAF20907.1|AF202049_1[6644105]

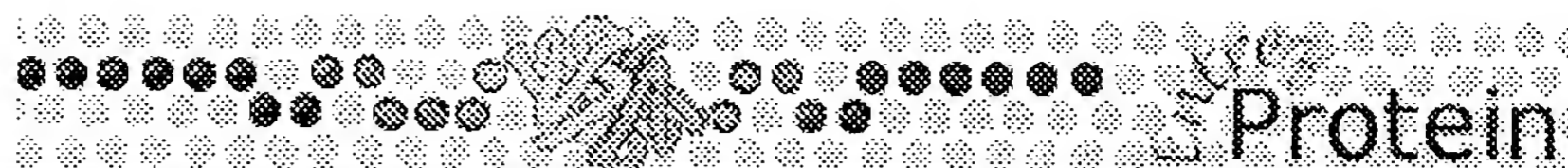
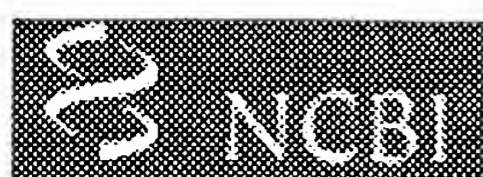
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		Limits	Preview/Index	History	Clipboard	Details			

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☐ **201:** [AAF20906](#) BLink, Domains, Links
NM23-M7 [Mus musculus]
gi|6644103|gb|AAF20906.1|AF202048_1[6644103]

Related resources

☐ **202:** [AAC78465](#) BLink, Domains, Links
type 6 nucleoside diphosphate kinase NM23-R6 [Rattus norvegicus]
gi|3228534|gb|AAC78465.1|[3228534]

☐ **203:** [AAC78464](#) BLink, Domains, Links
type 6 nucleoside diphosphate kinase NM23-M6 [Mus musculus]
gi|3228532|gb|AAC78464.1|[3228532]

☐ **204:** [AAC78463](#) BLink, Domains, Links
type 6 nucleoside diphosphate kinase NM23-H6 [Homo sapiens]
gi|3228530|gb|AAC78463.1|[3228530]

☐ **205:** [AAE11435](#) BLink, Links
Sequence 2 from patent US 5817783
gi|5970097|gb|AAE11435.1|pat|US|5817783|2[5970097]

☐ **206:** [AAD38977](#) BLink, Domains, Links
nucleoside diphosphate kinase [Mus musculus]
gi|5059340|gb|AAD38977.1|AF153451_1[5059340]

☐ **207:** [AAD38976](#) BLink, Domains, Links
nucleoside diphosphate kinase [Mus musculus]
gi|5059338|gb|AAD38976.1|AF153449_1[5059338]

☐ **208:** [CAB37870](#) BLink, Domains, Links
NM23-H2 protein [Homo sapiens]
gi|4467843|emb|CAB37870.1|[4467843]

☐ **209:** [AAD08900](#) BLink, Domains, Links

nucleoside diphosphate kinase; NDP kinase [Scyliorhinus torazame]
gi|4176739|gb|AAD08900.1|[4176739]

☐ **210:** AAC64358

[BLink](#), [Domains](#), [Links](#)

nm23-H5 [Homo sapiens]
gi|3220239|gb|AAC64358.1|[3220239]

☐ **211:** AAC44154

[BLink](#), [Domains](#), [Links](#)

Ndk
gi|1353658|gb|AAC44154.1|[1353658]

☐ **212:** CAA75226

[BLink](#), [Domains](#), [Links](#)

nucleoside-diphosphate kinase [Homo sapiens]
gi|3559927|emb|CAA75226.1|[3559927]

☐ **213:** 1NUEF

[BLink](#), [Domains](#), [Links](#)

Chain F, Nucleoside Triphosphate, Nucleoside Diphosphate Mol_id: 1;
Molecule: Nucleoside Diphosphate Kinase; Chain: A, B, C, D, E, F; Ec:
2.7.4.6
gi|1421614|pdb|1NUE|F[1421614]

☐ **214:** 1NUEE

[BLink](#), [Domains](#), [Links](#)

Chain E, Nucleoside Triphosphate, Nucleoside Diphosphate Mol_id: 1;
Molecule: Nucleoside Diphosphate Kinase; Chain: A, B, C, D, E, F; Ec:
2.7.4.6
gi|1421613|pdb|1NUE|E[1421613]

☐ **215:** 1NUED

[BLink](#), [Domains](#), [Links](#)

Chain D, Nucleoside Triphosphate, Nucleoside Diphosphate Mol_id: 1;
Molecule: Nucleoside Diphosphate Kinase; Chain: A, B, C, D, E, F; Ec:
2.7.4.6
gi|1421612|pdb|1NUE|D[1421612]

☐ **216:** 1NUEC

[BLink](#), [Domains](#), [Links](#)

Chain C, Nucleoside Triphosphate, Nucleoside Diphosphate Mol_id: 1;
Molecule: Nucleoside Diphosphate Kinase; Chain: A, B, C, D, E, F; Ec:
2.7.4.6
gi|1421611|pdb|1NUE|C[1421611]

☐ **217:** 1NUEB

[BLink](#), [Domains](#), [Links](#)

Chain B, Nucleoside Triphosphate, Nucleoside Diphosphate Mol_id: 1;
Molecule: Nucleoside Diphosphate Kinase; Chain: A, B, C, D, E, F; Ec:
2.7.4.6
gi|1421610|pdb|1NUE|B[1421610]

☐ **218:** 1NUEA

[BLink](#), [Domains](#), [Links](#)

Chain A, Nucleoside Triphosphate, Nucleoside Diphosphate Mol_id: 1;

Molecule: Nucleoside Diphosphate Kinase; Chain: A, B, C, D, E, F; Ec:
2.7.4.6
gi|1421609|pdb|1NUE|A[1421609]

☐ **219: 1NSKO**

[BLink](#), [Domains](#), [Links](#)

Chain O, Mol_id: 1; Molecule: Nucleoside Diphosphate Kinase; Chain: R, L,
T, U, N, O; Ec: 2.7.4.6; Engineered: Yes
gi|1311292|pdb|1NSK|O[1311292]

☐ **220: 1NSKN**

[BLink](#), [Domains](#), [Links](#)

Chain N, Mol_id: 1; Molecule: Nucleoside Diphosphate Kinase; Chain: R, L,
T, U, N, O; Ec: 2.7.4.6; Engineered: Yes
gi|1311291|pdb|1NSK|N[1311291]

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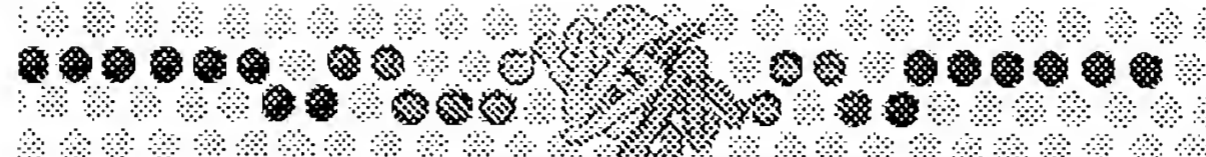

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Chain U, Mol_id: 1; Molecule: Nucleoside Diphosphate Kinase; Chain: R, L, T, U, N, O; Ec: 2.7.4.6; Engineered: Yes
[gi|1311290|pdb|1NSK|U\[1311290\]](#)

Related resources

☐ **222: [1NSKT](#)**[BLink](#), [Domains](#), [Links](#)

Chain T, Mol_id: 1; Molecule: Nucleoside Diphosphate Kinase; Chain: R, L, T, U, N, O; Ec: 2.7.4.6; Engineered: Yes
[gi|1311289|pdb|1NSK|T\[1311289\]](#)

☐ **223: [1NSKL](#)**[BLink](#), [Domains](#), [Links](#)

Chain L, Mol_id: 1; Molecule: Nucleoside Diphosphate Kinase; Chain: R, L, T, U, N, O; Ec: 2.7.4.6; Engineered: Yes
[gi|1311288|pdb|1NSK|L\[1311288\]](#)

☐ **224: [1NSKR](#)**[BLink](#), [Domains](#), [Links](#)

Chain R, Mol_id: 1; Molecule: Nucleoside Diphosphate Kinase; Chain: R, L, T, U, N, O; Ec: 2.7.4.6; Engineered: Yes
[gi|1311287|pdb|1NSK|R\[1311287\]](#)

☐ **225: [AAB99857](#)**[BLink](#), [Domains](#), [Links](#)

nucleoside diphosphate kinase [Gallus gallus]
[gi|2827446|gb|AAB99857.1|\[2827446\]](#)

☐ **226: [AAB99856](#)**[BLink](#), [Domains](#), [Links](#)

nucleoside diphosphate kinase [Gallus gallus]
[gi|2827444|gb|AAB99856.1|\[2827444\]](#)

☐ **227: [AAB87689](#)**[BLink](#), [Domains](#), [Links](#)

nucleoside diphosphate kinase A [Mus musculus]
[gi|2654092|gb|AAB87689.1|\[2654092\]](#)

☐ **228: [CAA68877](#)**[BLink](#), [Domains](#), [Links](#)

nucleoside-diphosphate kinase [Homo sapiens]
gi|1945762|emb|CAA68877.1|[1945762]

☐ **229:** AAB42080

[BLink](#), [Domains](#), [Links](#)

nucleoside diphosphate kinase A long form [Mus musculus]
gi|1816594|gb|AAB42080.1|[1816594]

☐ **230:** CAA66475

[BLink](#), [Domains](#), [Links](#)

NM23/nucleoside diphosphate kinase [Xenopus laevis]
gi|1655710|emb|CAA66475.1|[1655710]

☐ **231:** CAA66476

[BLink](#), [Domains](#), [Links](#)

NM23/nucleoside diphosphate kinase [Xenopus laevis]
gi|1655708|emb|CAA66476.1|[1655708]

☐ **232:** CAA66474

[BLink](#), [Domains](#), [Links](#)

NM23/nucleoside diphosphate kinase [Xenopus laevis]
gi|1655706|emb|CAA66474.1|[1655706]

☐ **233:** CAA66473

[BLink](#), [Domains](#), [Links](#)

NM23/nucleoside diphosphate kinase [Xenopus laevis]
gi|1655704|emb|CAA66473.1|[1655704]

☐ **234:** CAA48275

[BLink](#), [Domains](#), [Links](#)

nucleoside diphosphate kinase B [Mus musculus]
gi|53354|emb|CAA48275.1|[53354]

☐ **235:** AAB31385

[BLink](#), [Links](#)

nucleoside diphosphate kinase, NDPK=Nm23 protein homolog {N-terminal}
{EC 2.7.4.6} [Avena sativa=oats, Garry, Peptide Partial, 24 aa]
gi|619331|gb|AAB31385.1||bbm|346701|bbs|152843[619331]

☐ **236:** 1516349B

[BLink](#), [Domains](#), [Links](#)

nm23 gene
gi|226527|prf|1516349B[226527]

☐ **237:** 1516349A

[BLink](#), [Domains](#), [Links](#)

nm23 gene
gi|226526|prf|1516349A[226526]

☐ **238:** CAA51527

[BLink](#), [Domains](#), [Links](#)

NM23H1 [Homo sapiens]
gi|312824|emb|CAA51527.1|[312824]

☐ **239:** AAA86745

[BLink](#), [Links](#)

nucleoside diphosphate kinase B
gi|924935|gb|AAA86745.1|[924935]

☐ **240:** [AAA85097](#)

[BLink](#), [Domains](#), [Links](#)

DR-nm23 gene product
gi|1051256|gb|AAA85097.1|[1051256]

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File 266: FEDRIP 2004/Jun

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File 358: Current BioTech Abs 1983-2004/Sep

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File 40: Enviroline(R) 1975-2004/Aug

File 50: CAB Abstracts 1972-2004/Aug

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7.

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?s nm23? (s) (protein? or polypeptide? or peptide?)

Processing

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Processing

Processed 20 of 37 files ...

Completed processing all files

6959 NM23?

11635249 PROTEIN?

583440 POLYPEPTIDE?

2395895 PEPTIDE?

S1 4029 NM23? (S) (PROTEIN? OR POLYPEPTIDE? OR PEPTIDE?)

?s s1 (s) (rad or (ras related protein associated with diabetes))

4029 S1

63724 RAD

0 RAS RELATED PROTEIN ASSOCIATED WITH DIABETES

S2 35 S1 (S) (RAD OR (RAS RELATED PROTEIN ASSOCIATED WITH DIABETES))

diabetes))

```
      4029 S1
      63724 RAD
      0 RAS RELATED PROTEIN ASSOCIATED WITH DIABETES
S4      37 S1 AND (RAD OR (RAS RELATED PROTEIN ASSOCIATED WITH
      DIABETES))
```

?rd

...completed examining records

```
S5      10 RD (unique items)
```

?s s5 not s3

```
      10 S5
      8 S3
S6      2 S5 NOT S3
```

?show rilds;ds;t/3,k/all

>>>Invalid SHOW option: RILDS

Set	Items	Description
S1	4029	NM23? (S) (PROTEIN? OR POLYPEPTIDE? OR PEPTIDE?)
S2	35	S1 (S) (RAD OR (RAS RELATED PROTEIN ASSOCIATED WITH DIABET- ES))
S3	8	RD (unique items)
S4	37	S1 AND (RAD OR (RAS RELATED PROTEIN ASSOCIATED WITH DIABET- ES))
S5	10	RD (unique items)
S6	2	S5 NOT S3

>>>KWIC option is not available in file(s): 399

File 5: Biosis Previews(R) 1969-2004/Sep W4
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File 98: General Sci Abs/Full-Text 1984-2004/Aug
(c) 2004 The HW Wilson Co.
File 99: Wilson Appl. Sci & Tech Abs 1983-2004/Aug
(c) 2004 The HW Wilson Co.
File 135: NewsRx Weekly Reports 1995-2004/Sep W4
(c) 2004 NewsRx

***File 135: New newsletters are now added. See Help News135 for the complete list of newsletters.**

File 143: Biol. & Agric. Index 1983-2004/Aug
(c) 2004 The HW Wilson Co
File 144: Pascal 1973-2004/Sep W3
(c) 2004 INIST/CNRS
File 155: MEDLINE(R) 1951-2004/Sep W4
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***File 155: Medline has been reloaded. Accession numbers have changed. Please see HELP NEWS 154 for details.**

File 172: EMBASE Alert 2004/Sep W3
(c) 2004 Elsevier Science B.V.
File 266: FEDRIP 2004/Jun
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File 315: ChemEng & Biotech Abs 1970-2004/Sep
(c) 2004 DECHEMA
File 357: Derwent Biotech Res. 1982-2004/Sep W4
(c) 2004 Thomson Derwent & ISI
File 358: Current BioTech Abs 1983-2004/Sep
(c) 2004 DECHEMA
File 369: New Scientist 1994-2004/Sep W3
(c) 2004 Reed Business Information Ltd.
File 370: Science 1996-1999/Jul W3
(c) 1999 AAAS

***File 370: This file is closed (no updates). Use File 47 for more current information.**

File 399: CA SEARCH(R) 1967-2004/UD=14114
(c) 2004 American Chemical Society

***File 399: Use is subject to the terms of your user/customer agreement.**
Alert feature enhanced for multiple files, etc. See HELP ALERT.

File 434: SciSearch(R) Cited Ref Sci 1974-1989/Dec
(c) 1998 Inst for Sci Info
File 40: Enviroline(R) 1975-2004/Aug
File 50: CAB Abstracts 1972-2004/Aug
(c) 2004 CAB International
File 103: Energy SciTec 1974-2004/Aug B2
(c) 2004 Contains copyrighted material

***File 103: For access restrictions see Help Restrict.**

File 156: ToxFile 1965-2004/Sep W4
(c) format only 2004 The Dialog Corporation

***File 156: ToxFile now reloaded with 2004 MeSH.**
Enter Help News156 for more information.

File 162: Global Health 1983-2004/Aug
(c) 2004 CAB International
File 305: Analytical Abstracts 1980-2004/Sep W4

(c) 2004 Royal Soc Chemistry
***File 305: Alert feature enhanced for multiple files, duplicate removal, customized scheduling. See HELP ALERT.**

File 35:Dissertation Abs Online 1861-2004/Aug

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File 48:SPORTDiscus 1962-2004/Sep

(c) 2004 Sport Information Resource Centre

File 91:MANTIS(TM) 1880-2004/Sep

2001 (c) Action Potential

File 149:TGG Health&Wellness DB(SM) 1976-2004/Sep W1

(c) 2004 The Gale Group

File 159:Cancerlit 1975-2002/Oct

(c) format only 2002 Dialog Corporation

***File 159: Cancerlit is no longer updating.**

Please see HELP NEWS159.

File 164:Allied & Complementary Medicine 1984-2004/Sep

(c) 2004 BLHCIS

File 444:New England Journal of Med. 1985-2004/Sep W4

(c) 2004 Mass. Med. Soc.

File 467:ExtraMED(tm) 2000/Dec

(c) 2001 Informania Ltd.

***File 467: F467 no longer updates; see Help News467.**

7.

Set Items Description

--- -----

?s nm23? (s) (protein? or polypeptide? or peptide?)

Processing

Processed 10 of 37 files ...

Processing

Processed 20 of 37 files ...

Completed processing all files

6959 NM23?

11635249 PROTEIN?

583440 POLYPEPTIDE?

2395895 PEPTIDE?

S1 4029 NM23? (S) (PROTEIN? OR POLYPEPTIDE? OR PEPTIDE?)

?s s1 (s) (rad or (ras related protein associated with diabetes))

4029 S1

63724 RAD

0 RAS RELATED PROTEIN ASSOCIATED WITH DIABETES

S2 35 S1 (S) (RAD OR (RAS RELATED PROTEIN ASSOCIATED WITH DIABETES))

?rd

...completed examining records

S3 8 RD (unique items)

?show files;ds;t/3,k/all

File 5:Biosis Previews(R) 1969-2004/Sep W4

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File 8:Ei Compendex(R) 1970-2004/Sep W3

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 File 399:CA SEARCH(R) 1967-2004/UD=14114
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 File 156:ToxFile 1965-2004/Sep W4
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 File 162:Global Health 1983-2004/Aug
 (c) 2004 CAB International
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 File 48:SPORTDiscus 1962-2004/Sep
 (c) 2004 Sport Information Resource Centre
 File 91:MANTIS(TM) 1880-2004/Sep
 2001 (c) Action Potential
 File 149:TGG Health&Wellness DB(SM) 1976-2004/Sep W1
 (c) 2004 The Gale Group
 File 159:Cancerlit 1975-2002/Oct
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 File 164:Allied & Complementary Medicine 1984-2004/Sep
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 File 444:New England Journal of Med. 1985-2004/Sep W4
 (c) 2004 Mass. Med. Soc.
 File 467:ExtraMED(tm) 2000/Dec
 (c) 2001 Informania Ltd.

Set	Items	Description
S1	4029	NM23? (S) (PROTEIN? OR POLYPEPTIDE? OR PEPTIDE?)
S2	35	S1 (S) (RAD OR (RAS RELATED PROTEIN ASSOCIATED WITH DIABET-ES))
S3	8	RD (unique items)

>>>KWIC option is not available in file(s): 399

3/3,K/1 (Item 1 from file: 5)
 DIALOG(R)File 5:Biosis Previews(R)
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0014045547 BIOSIS NO.: 200300004266

Menin, the multiple endocrine neoplasia type 1 gene product, exhibits GTP-hydrolyzing activity in the presence of the tumor metastasis

suppressor nm23.

AUTHOR: Yaguchi Hiroko; Ohkura Naganari (Reprint); Tsukada Toshihiko;
Yamaguchi Ken
AUTHOR ADDRESS: Growth Factor Division, National Cancer Center Research
Institute, 5-1-1 Tsukiji, Chuo-ku, Tokyo, 104-0045, Japan**Japan
AUTHOR E-MAIL ADDRESS: nohkura@gan2.ncc.go.jp
JOURNAL: Journal of Biological Chemistry 277 (41): p38197-38204 October
11, 2002 2002
MEDIUM: print
ISSN: 0021-9258
DOCUMENT TYPE: Article
RECORD TYPE: Abstract
LANGUAGE: English

ABSTRACT: MEN1, the gene responsible for multiple endocrine neoplasia type 1, is a tumor suppressor gene that encodes a *protein* called menin, of unknown function with no homology to any known *protein*. Here we demonstrate that menin interacts with a putative tumor metastasis suppressor *nm23H1*/nucleoside diphosphate (NDP) kinase A in mammalian cells. Given the roles of *nm23* as a multi-functional *protein*, we searched for the possible function of menin. Menin has no effect on the known activities of *nm23*; that is, nucleoside diphosphate kinase, *protein* kinase, or GTPase-activating *protein* for Ras-related GTPase *Rad*. However, we found that menin hydrolyzes GTP to GDP efficiently in the presence of *nm23*, whereas *nm23* or menin alone shows little or no detectable GTPase activity. Furthermore, menin contains sequence motifs similar to those found in all known GTPases or GTP-binding *proteins* and shows low affinity but specific binding to GTP/GDP. These results suggest that menin is an atypical GTPase stimulated by *nm23*.

3/3,K/2 (Item 2 from file: 5)

DIALOG(R)File 5:Biosis Previews(R)
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0013093839 BIOSIS NO.: 200100265678

Tumor metastasis suppressor nm23H1 regulates Rac1 GTPase by interaction with Tiam1

AUTHOR: Otsuki Yoshiro; Tanaka Masamitsu; Yoshii Shigeto; Kawazoe Nobuko;
Nakaya Kazuyasu; Sugimura Haruhiko (Reprint)
AUTHOR ADDRESS: First Department of Pathology, Hamamatsu University School
of Medicine, 3600 Handa-cho, Hamamatsu, 431-3192, Japan**Japan
JOURNAL: Proceedings of the National Academy of Sciences of the United
States of America 98 (8): p4385-4390 April 10, 2001 2001
MEDIUM: print
ISSN: 0027-8424
DOCUMENT TYPE: Article
RECORD TYPE: Abstract
LANGUAGE: English

ABSTRACT: The putative tumor metastasis suppressor *nm23H1* was originally identified in murine melanomas by subtraction cloning. It displays nucleoside diphosphate kinase activity and regulates cellular events, including growth and development. Recently *nm23H1* has been reported to also act as a GTPase-activating *protein* of the Ras-related GTPase *Rad*. We attempted to determine whether *nm23H1* also regulates Rho-family GTPases. Although we were unable to detect a direct association between *nm23H1* and Rho-family GTPases, *nm23H1* was shown to be associated with a Rac1-specific nucleotide exchange factor, Tiam1, by interaction with its amino-terminal region in extracts from the cells expressing exogenous Tiam1 and from native tissue. Overexpression of *nm23H1* inhibited the Tiam1-induced production of GTP-bound Rac1 and activation of c-Jun kinase. On the other hand, forced overexpression of the wild type, but not the kinase-inactivated mutant of *nm23H1*, converted the GDP-bound forms of Rac1, Cdc42, and RhoA to their GTP-bound forms in vitro by its nucleoside diphosphate kinase activity, but *nm23H1* alone apparently did not produce the GTP-bound form of these GTPases in vivo. These results

suggest that *nm23H1* negatively regulates Tiam1 and inhibits Rac1 activation in vivo. Moreover, adhesion-stimulated membrane ruffles of Rat1 fibroblasts were reduced by overexpression of *nm23H1*. Based on these observations, we concluded that we had identified a function of *nm23H1* as a regulator of Rac1 and that it may be related to the effect of *nm23H1* as a tumor metastasis suppressor.

3/3,K/3 (Item 3 from file: 5)
DIALOG(R)File 5:Biosis Previews(R)
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0013012947 BIOSIS NO.: 200100184786

Regulation of growth and tumorigenicity of breast cancer cells by the low molecular weight GTPase Rad and Nm23

AUTHOR: Tseng Yu-Hua; Vicent David; Zhu Jianhua; Niu Yulian; Adeyinka Adewale; Moyers Julie S; Watson Peter H; Kahn C Ronald (Reprint)

AUTHOR ADDRESS: Joslin Diabetes Center, One Joslin Place, Boston, MA, 02215, USA**USA

JOURNAL: Cancer Research 61 (5): p2071-2079 March 1, 2001 2001

MEDIUM: print

ISSN: 0008-5472

DOCUMENT TYPE: Article

RECORD TYPE: Abstract

LANGUAGE: English

ABSTRACT: *Rad* is the prototypic member of a family of novel Ras-related GTPases that is normally expressed in heart, skeletal muscle, and lung and that has been shown to exhibit a novel form of bi-directional interaction with the *nm23* metastasis suppressor. In the present study, we have investigated the expression of *Rad* in normal and neoplastic breast tissues by Western blot and immunohistochemistry and the functional effect of altered *Rad* expression in breast cancer cell lines. We found that, although *Rad* is frequently expressed in normal breast tissue (23/30 *Rad*+ve), expression is usually lost in adjacent invasive carcinoma (8/30 *Rad*+ve; $P < 0.0001$). However, where *Rad* expression persists in a small proportion of tumors, it is associated with higher grade, larger size, and extensive axillary nodal involvement ($n = 48$; $P = 0.035$, $P = 0.016$, $P = 0.022$, respectively). Furthermore, *Rad* is also highly expressed in a breast cancer cell line with high tumorigenic and metastatic potential (MDA-MB231). To further examine the role of *Rad* in breast cancer, we stably transfected a *Rad*-ve breast cancer cell line (MDA-MB435). We observed an increase in growth and marked increased colony formation in soft agar in vitro ($P < 0.05$) and an increase in tumor growth rate in nude mice ($P < 0.05$). Moreover, coexpression of *nm23* with wild-type *Rad* inhibited the effect of *Rad* on growth of these cells in culture and markedly inhibited tumor growth in vivo. Additional transfection studies with mutated *Rad* cDNAs revealed that the growth-promoting effects of *Rad* appeared to be mediated through its NH2- and COOH-terminal regions, rather than its GTPase domain, and might involve acceleration of cell cycle transition. These findings suggest that *Rad* may act as an oncogenic *protein* in breast tissues and demonstrate a potential mechanism by which interaction between *Rad* and *nm23* may regulate growth and tumorigenicity of breast cancer.

3/3,K/4 (Item 4 from file: 5)
DIALOG(R)File 5:Biosis Previews(R)
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0012369749 BIOSIS NO.: 200000088062

Interaction of the Ras-related *protein* associated with diabetes *Rad* and the putative tumor metastasis suppressor *NM23* provides a novel mechanism of GTPase regulation

AUTHOR: Zhu Jianhua; Tseng Yu-Hua; Kantor Jason D; Rhodes Christopher J; Zetter Bruce R; Moyers Julie S; Kahn C Ronald (Reprint)

AUTHOR ADDRESS: Research Division, Joslin Diabetes Center, Department of
Medicine, Harvard Medical School, One Joslin Place, Boston, MA, 02215,
USA**USA

JOURNAL: Proceedings of the National Academy of Sciences of the United
States of America 96 (26): p14911-14918 Dec. 21, 1999 1999

MEDIUM: print

ISSN: 0027-8424

DOCUMENT TYPE: Article

RECORD TYPE: Abstract

LANGUAGE: English

**Interaction of the Ras-related *protein* associated with diabetes *Rad* and
the putative tumor metastasis suppressor *NM23* provides a novel
mechanism of GTPase regulation**

ABSTRACT: *Rad* is the prototypic member of a new class of Ras-related
GTPases. Purification of the GTPase-activating *protein* (GAP) for *Rad*
revealed *nm23*, a putative tumor metastasis suppressor and a development
gene in Drosophila. Antibodies against *nm23* depleted *Rad*-GAP activity
from human skeletal muscle cytosol, and bacterially expressed *nm23*
reconstituted the activity. The GAP activity of *nm23* was specific for
Rad, was absent with the S105N putative dominant negative mutant of
Rad, and was reduced with mutations of *nm23*. In the presence of ATP,
GDPcndtdotRad was also reconverted to GTPcndtdotRad by the nucleoside
diphosphate (NDP) kinase activity of *nm23*. Simultaneously, *Rad*
regulated *nm23* by enhancing its NDP kinase activity and decreasing its
autophosphorylation. Melanoma cells transfected with wild-type *Rad*, but
not the S105N-*Rad*, showed enhanced DNA synthesis in response to serum;
this effect was lost with coexpression of *nm23*. Thus, the interaction
of *nm23* and *Rad* provides a potential novel mechanism for
bidirectional, bimolecular regulation in which *nm23* stimulates both GTP
hydrolysis and GTP loading of *Rad* whereas *Rad* regulates activity of
nm23. This interaction may play important roles in the effects of *Rad*
on glucose metabolism and the effects of *nm23* on tumor metastasis and
developmental regulation.

3/3,K/5 (Item 5 from file: 5)

DIALOG(R)File 5:Biosis Previews(R)

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0011609263 BIOSIS NO.: 199800403510

Effects of phosphorylation on function of the Rad GTPase

AUTHOR: Moyers Julie S; Zhu Jianhua; Kahn C Ronald (Reprint)

AUTHOR ADDRESS: Res. Div., Joslin Diabetes Center, One Joslin Place,
Boston, MA 02215, USA**USA

JOURNAL: Biochemical Journal 333 (3): p609-614 Aug. 1, 1998 1998

MEDIUM: print

ISSN: 0264-6021

DOCUMENT TYPE: Article

RECORD TYPE: Abstract

LANGUAGE: English

ABSTRACT: *Rad*, Gem and Kir possess unique structural features in
comparison with other Ras-like GTPases, including a C-terminal 31-residue
extension that lacks typical prenylation motifs. We have recently shown
that *Rad* and Gem bind calmodulin in a Ca²⁺-dependent manner via this
C-terminal extension, involving residues 278-297 in human *Rad*. This
domain also contains several consensus sites for serine phosphorylation,
and *Rad* is complexed with calmodulin-dependent *protein* kinase II
(CaMKII) in C2C12 cells. Here we show that *Rad* serves as a substrate
for phosphorylation by CaMKII, cAMP-dependent *protein* kinase (PKA),
protein kinase C (PKC) and casein kinase II (CKII) with stoichiometries
in vitro of 0.2-1.3 mol of phosphate/mol of *Rad*. By deletion and point
mutation analysis we show that phosphorylation by CaMKII and PKA occurs
on a single serine residue at position 273, whereas PKC and CKII
phosphorylate multiple C-terminal serine residues, including Ser214,
Ser257, Ser273, Ser290 and Ser299. Incubation of *Rad* with PKA decreases

GTP binding by 60-70%, but this effect seems to be independent of phosphorylation, as it is observed with the Ser273 foward Ala mutant of *Rad* containing a mutation at the site of PKA phosphorylation. The remainder of the serine kinases have no effect on *Rad* GTP binding, intrinsic GTP hydrolysis or GTP hydrolysis stimulated by the putative tumour metastasis suppressor *nm23*. However, phosphorylation of *Rad* by PKC and CKII abolishes the interaction of *Rad* with calmodulin. These findings suggest that the binding of *Rad* to calmodulin, as well as its ability to bind GTP, might be regulated by the activation of several serine kinases.

3/3,K/6 (Item 1 from file: 357)
DIALOG(R)File 357:Derwent Biotech Res.
(c) 2004 Thomson Derwent & ISI. All rts. reserv.

0230112 DBR Accession No.: 99-00213 PATENT
New method of modulating the activity of nm23 in individuals at risk from proliferative disorders - Rad mutant protein, antisense nucleic acid and antibody, used for diabetes, obesity, wound healing, tissue replacement and cancer therapy, gene therapy and drug screening
AUTHOR: Kahn C R; Zhu J
CORPORATE SOURCE: Boston, MA, USA.
PATENT ASSIGNEE: Joslin-Diabetes-Center 1998
PATENT NUMBER: WO 9844088 PATENT DATE: 981008 WPI ACCESSION NO.: 98-542695 (9846)
PRIORITY APPLIC. NO.: US 43983 APPLIC. DATE: 970403
NATIONAL APPLIC. NO.: WO 98US6521 APPLIC. DATE: 980402
LANGUAGE: English

ABSTRACT: A new method of modulating the activity of *nm23* in individuals at risk from proliferative disorders involves modulating the level of *Rad* activity. Activity of *nm23* in a cell or subject may be increased by administering a *Rad* *protein* or DNA encoding a *Rad* *protein* , and the level can be decreased by adding antisense nucleic acid which decreases *Rad* expression, by administering an anti-*Rad* antibody or a DNA sequence encoding the antibody, or by administering a *Rad* mutant or DNA encoding a *Rad* mutant. The new method may be used to treat diabetes, obesity, neuron or muscle cell development disorders, wound healing and tissue replacement, or various cancers...

... whether a subject is at risk of developing e.g. cancer, or for evaluating the ability of a test compound to modulate the interaction between *Rad* and *nm23* *proteins*. (32pp)

DESCRIPTORS: human *nm23*, *Rad* *protein* interaction modulation, *Rad* mutant *protein*, antisense nucleic acid, antibody, appl. diabetes, obesity, neuron, muscle cell development disorder, wound healing, tissue replacement, cancer susceptibility det., therapy, gene therapy, drug screening vulnerary...

3/3,K/7 (Item 1 from file: 399)
DIALOG(R)File 399:CA SEARCH(R)
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129270613 CA: 129(21)270613v PATENT
Modulating the Rad-nm23 interaction in subjects at risk for proliferative disorders
INVENTOR(AUTHOR): Kahn, C. Ronald; Zhu, Jinhua
LOCATION: USA
ASSIGNEE: Joslin Diabetes Center, Inc.
PATENT: PCT International ; WO 9844088 A2 DATE: 19981008
APPLICATION: WO 98US6521 (19980402) *US 43983 (19970403)
PAGES: 32 pp. CODEN: PIXXD2 LANGUAGE: English CLASS: C12N-000/A
DESIGNATED COUNTRIES: AL; AM; AT; AU; AZ; BA; BB; BG; BR; BY; CA; CH; CN; CZ; DE; DK; EE; ES; FI; GB; GE; GH; GM; GW; HU; ID; IL; IS; JP; KE; KG; KP; KR; KZ; LC; LK; LR; LS; LT; LU; LV; MD; MG; MK; MN; MW; MX; NO; NZ; PL; PT;

RO; RU; SD; SE; SG; SI; SK; SL; TJ; TM; TR; TT; UA; UG; US; UZ; VN; YU; ZW;
AM; AZ; BY; KG; KZ; MD; RU; TJ; TM DESIGNATED REGIONAL: GH; GM; KE; LS; MW
; SD; SZ; UG; ZW; AT; BE; CH; CY; DE; DK; ES; FI; FR; GB; GR; IE; IT; LU;
MC; NL; PT; SE; BF; BJ; CF; CG; CI; CM; GA; GN; ML; MR; NE; SN; TD; TG

3/3,K/8 (Item 1 from file: 149)
DIALOG(R)File 149:TGG Health&Wellness DB(SM)
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01312500 SUPPLIER NUMBER: 11576824 (USE FORMAT 7 OR 9 FOR FULL TEXT)
Activation of a small GTP-binding protein by nucleoside diphosphate kinase.
Randazzo, Paul A.; Northup, John K.; Kahn, Richard A.
Science, v254, n5033, p850(4)
Nov 8,
1991
PUBLICATION FORMAT: Magazine/Journal ISSN: 0036-8075 LANGUAGE: English
RECORD TYPE: Fulltext TARGET AUDIENCE: Academic
WORD COUNT: 2468 LINE COUNT: 00236

... Contamination of ARF, G protein, and [beta][gamma] preparations is common.

[10] P. A. Randazzo and R. A. Kahn, unpublished data.

[11] To prepare recombinant *nm23*-H1, *nm23*-H2, and *nm23*-1, the coding regions were amplified by the polymerase chain reaction (PCR) with cDNAs (supplied by P. Steeg) as template and synthetic oligonucleotides that incorporate...

...fragments were inserted into pET3C (supplied by W. Studier) at Nde I and Bam HI sites. BL21 (DE3) cells, were transfected with the plasmid and *protein* expression was induced with IPTG. The bacteria were lysed by sonication and after centrifugation (45 min at 100,000g), ammonium sulfate (40%) was added to...

...was suspended in and dialyzed against 20 mM tris (pH 7.4) containing NaCl (0.9%). The dialysate was fractionated on hydroxylapatite (5 ml, Bio-*Rad* HTP), equilibrated in a buffer (TED) containing 20 mM tris (pH 7.4), 1 mM EDTA, 1 mM DTT. The column was washed with TED4.3, and 23 mg of *nm23*-H1, *nm23*-H2, and *nm23*-1, respectively, consistent with their level of expression in BL21 (DE3) cells. Specific activities determined with deoxythymidine 5'-diphosphate as a substrate and the coupled...

...Parks, Methods Enzymol. 51, 376 (1978)] were 482 U/mg, 740 U/mg, 724 U/mg, and 257 U/mg at 20[degrees]C for *nm23*-H1, *nm23*-H2, *nm23*-1, and Sigma enzyme N-2635 (bovine liver), respectively. The *proteins* were estimated to be 90% pure by staining with Coomassie blue.

[12] To determine kinetic parameters, [[alpha].-sup.32]P]GDP or [[alpha].-sup.32...

?

?rd
 ...completed examining records
 S5 10 RD (unique items)
 ?s s5 not s3
 10 S5
 8 S3
 S6 2 S5 NOT S3
 ?show rilds;ds;t/3,k/all
 >>>Invalid SHOW option: RILDS

Set	Items	Description
S1	4029	NM23? (S) (PROTEIN? OR POLYPEPTIDE? OR PEPTIDE?)
S2	35	S1 (S) (RAD OR (RAS RELATED PROTEIN ASSOCIATED WITH DIABET- ES))
S3	8	RD (unique items)
S4	37	S1 AND (RAD OR (RAS RELATED PROTEIN ASSOCIATED WITH DIABET- ES))
S5	10	RD (unique items)
S6	2	S5 NOT S3

>>>KWIC option is not available in file(s): 399

6/3,K/1 (Item 1 from file: 5)
 DIALOG(R)File 5:Biosis Previews(R)
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0013818594 BIOSIS NO.: 200200412105

**Integrin cytoplasmic domain-associated *protein* lalpha (ICAP-lalpha)
 interacts directly with the metastasis suppressor *nm23*-H2, and both
 proteins are targeted to newly formed cell adhesion sites upon integrin
 engagement**

AUTHOR: Fournier Henri-Noel; Dupe-Manet Sandra; Bouvard Daniel; Lacombe
 Marie-Lise; Marie Christiane; Block Marc R (Reprint); Albiges-Rizo
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**Integrin cytoplasmic domain-associated *protein* lalpha (ICAP-lalpha)
 interacts directly with the metastasis suppressor *nm23*-H2, and both
 proteins are targeted to newly formed cell adhesion sites upon integrin
 engagement**

ABSTRACT: Cell adhesion-dependent signaling implicates cytoplasmic
 proteins interacting with the intracellular tails of integrins. Among
 those, the integrin cytoplasmic domain-associated *protein* lalpha
 (ICAP-lalpha) has been shown to interact specifically with the beta1
 integrin cytoplasmic domain. Although it is likely that this *protein*
 plays an important role in controlling cell adhesion and migration,
 little is known about its actual function. To search for potential
 ICAP-lalpha-binding *proteins*, we used a yeast two-hybrid screen and
 identified the human metastatic suppressor *protein* *nm23*-H2 as a new
 partner of ICAP-lalpha. This direct interaction was confirmed in vitro,
 using purified recombinant ICAP-lalpha and *nm23*-H2, and by
 co-immunoprecipitation from CHO cell lysates over-expressing ICAP-lalpha.
 The physiological relevance of this interaction is provided by confocal
 fluorescence microscopy, which shows that ICAP-lalpha and *nm23*-H2 are
 co-localized in lamellipodia during the early stages of cell spreading.
 These adhesion sites are enriched in occupied beta1 integrins and precede
 the formation of focal adhesions devoid of ICAP-lalpha and *nm23*-H2,
 indicating the dynamic segregation of components of matrix adhesions.

This peripheral staining of ICAP-1alpha and *nm23*-H2 is only observed in cells spreading on fibronectin and collagen and is absent in cells spreading on poly-L-lysine, vitronectin, or laminin. This is consistent with the fact that targeting of both ICAP-1alpha and *nm23*-H2 to the cell periphery is dependent on beta1 integrin engagement rather than being a consequence of cell adhesion. This finding represents the first evidence that the tumor suppressor *nm23*-H2 could act on beta1 integrin-mediated cell adhesion by interacting with one of the integrin partners, ICAP-1alpha.

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...Abstract: their protein structural information and its significance was extended further on the basis of recent findings obtained with small molecular weight G proteins such as *Rad*, menin, and Rac. Meanwhile, observations suggesting involvement of NDP kinases in the regulation of cell growth and differentiation led to the realization that NDP kinases

...Identifiers--NERVE GROWTH-FACTOR; METASTASIS SUPPRESSOR *NM23*; PC12 PHEOCHROMOCYTOMA CELLS; ENDOCRINE NEOPLASIA TYPE-1; GTP-BINDING *PROTEIN*(GS); TUMOR-METASTASIS; NEURONAL DIFFERENTIATION; CRYSTAL-STRUCTURE; ADENYLATE-CYCLASE; ADP-RIBOSYLATION

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